CLAIMS

I claim:

1. In a method for externally sensing pressure of a fluid within a pressure vessel including the steps of

a. locating and mounting for rotation, a magnetic field source inside of the pressure vessel containing the fluid for providing a magnetic field having an axis of symmetry rotating in a particular plane;

b. coupling the magnetic field source to a pressure activated bellows also located inside of the pressure vessel expanding and contracting responsive to pressure differences ΔP between fluid pressure inside the pressure vessel and a known fluid pressure, the expansion and contraction of the bellows rotationally orienting the axis of symmetry of the provided magnetic field in the particular plane inside the pressure vessel;

c. sensing orientation of the axis of symmetry of the provided magnetic field outside the pressure vessel; and

d. correlating the orientation of the axis of symmetry of the magnetic field sensed to pressure within the pressure vessel,

the improvement wherein said sensing of the orientation of the axis of symmetry of the provided magnetic field outside the pressure vessel comprises the steps of:

(i) revolving the pressure vessel around an axis or rotation;

(ii) sensing one or more vector components of th provided magnetic field during a substantial part of one or more

revolutions of the revolving pressure vessel; and

(iii) analyzing one or more of said sensed vector components of the provided magnetic field to ascertain the orientation of the axis of symmetry of the magnetic field within the pressure vessel.

2. The improvement as recited in claim 1 wherein said analysis comprises computing the skew of a sensed vector component of the provided magnetic field.

3. The improvement as recited in claim 1 wherein said analysis comprises computing the ratio of skews of sensed vector components of the provided magnetic field.

4. The improvement as recited in claim 1 wherein the time rate of change of the provided magnetic field is sensed.

5. The improvement as recited in claim 1 wherein said pressure vessel comprises a combination of an inflated, annular pneumatic tire hermetically sealed around a wheel rim for a vehicle.

6. The improvement as recited in claim 5 wherein said analysis comprises computing the skew of a sensed vector component of the provided magnetic field.

7. The improvement as recited in claim 5 wherein said analysis comprises computing the ratio of skews of sensed vector components of the provided magnetic field.

8. The improvement as recited in claim 5 wher in the time rate of change of the provided magnetic field is sensed.

9. In a magnetically coupled pressure gauge for indicating fluid pressure within a pressure vessel outside the pressure vessel, comprising in combination,

a. a rotatable sender means mounted inside the pressure vessel for providing a rotatable magnetic field having a specific direction, the specific direction of the magnetic field in the plane parallel to an axis of symmetry of the magnetic field;

b. a pressure actuated bellows mechanism also mounted inside of the pressure vessel coupled for rotating the sender means rotationally changing orientation of the specific direction of the magnetic field in a plane parallel to to the axis of symmetry responsive to variations in fluid pressure within the vessel; and

c. sensor means mounted outside of the pressure vessel for sensing and indicating orientation of the specific direction of the magnetic field provided by the sender means in a plane parallel its axis of symmetry as rotated to a particular orientation by the pressure actuated bellows mechanism.

the improvement wherein said coupling of said sender means rotationally to a pressure activated bellows comprises, in combination,

(i) a helical ribbon composed of a high magnetic permeability material translated according to the expansion and contraction of said bellows; and

(ii) a magnetic circuit attached to the sender means aligning with said helical ribbon.

10. In a magnetically coupled pressure gauge for indicating fluid pressure within a

pressure vessel outside the pressure vessel, comprising in combination,

a. a rotatable sender means mounted inside the pressure vessel for providing a rotatable magnetic field having a specific direction, the specific direction of the magnetic field in the plane parallel to an axis of symmetry of the magnetic field;

b. a pressure actuated bellows mechanism also mounted inside of the pressure vessel coupled for rotating the sender means rotationally changing orientation of the specific direction of the magnetic field in a plane parallel to to the axis of symmetry responsive to variations in fluid pressure within the vessel; and

c. sensor means mounted outside of the pressure vessel for sensing and indicating orientation of the specific direction of the magnetic field provided by the sender means in a plane parallel its axis of symmetry as rotated to a particular orientation by the pressure actuated bellows mechanism.

the improvement wherein said coupling of said sender means rotationally to a pressure activated bellows comprises, in combination,

(i) a helical ribbon composed of a high magnetic permeability material translated according to the expansion and contraction of said bellows; and

(ii) a magnetic circuit attached to the sender means aligning with said helical ribbon.

11. In a magnetically coupled pressure gauge for indicating fluid pressure within a pressure vessel outside the pressure vessel, comprising in combination,

a. a rotatabl sender means mounted insid the pressur vessel for providing a rotatable magnetic field having a specific direction, the specific direction of the magnetic field in the plane parallel to an axis of symmetry of the magnetic field;

b. a pressure actuated bellows mechanism also mounted inside of the pressure vessel coupled for rotating the sender means rotationally changing orientation of the specific direction of the magnetic field in a plane parallel to to the axis of symmetry responsive to variations in fluid pressure within the vessel; and

c. sensor means mounted outside of the pressure vessel for sensing and indicating orientation of the specific direction of the magnetic field provided by the sender means in a plane parallel its axis of symmetry as rotated to a particular orientation by the pressure actuated bellows mechanism.

the improvement wherein said sensing of said specific direction of the magnetic field provided by said sender means comprises the steps of:

(i) revolving the pressure vessel around an axis or rotation;

(ii) sensing one or more vector components of the provided magnetic field during a substantial part of one or more revolutions of the revolving pressure vessel; and

(iii) analyzing one or more of said sensed vector components of the provided magnetic field to ascertain the orientation of the axis of symmetry of the magnetic field within the pressure vessel.

12. The improvement as recited in claim 11 wherein said analysis comprises computing the skew of a sensed vector compon nt of the provided magnetic

field.

13. The improvement as recited in claim 11 wherein said analysis comprises computing the ratio of skews of sensed vector components of the provided magnetic field.

14. The improvement as recited in claim 11 wherein the time rate of change of the provided magnetic field is sensed.

15. The improvement as recited in claim 11 wherein said pressure vessel comprises a combination of an inflated, annular pneumatic tire hermetically sealed around a wheel rim for a vehicle.

16. The improvement as recited in claim 15 wherein said analysis comprises computing the skew of a sensed vector component of the provided magnetic field. The improvement as recited in claim 15 wherein said analysis comprises computing the ratio of skews of sensed vector components of the provided magnetic field.

17. The improvement as recited in claim 15 wherein the time rate of change of the provided magnetic field is sensed.

18. The improvement as recited in claim 15 wherein the rotatable sender means is further mounted on the tire valve stem.

19. The improvement as recited in claim 18 wherein atmospheric pressure is communicated into the rotatable sender means through one or more passages in the tire valve stem.